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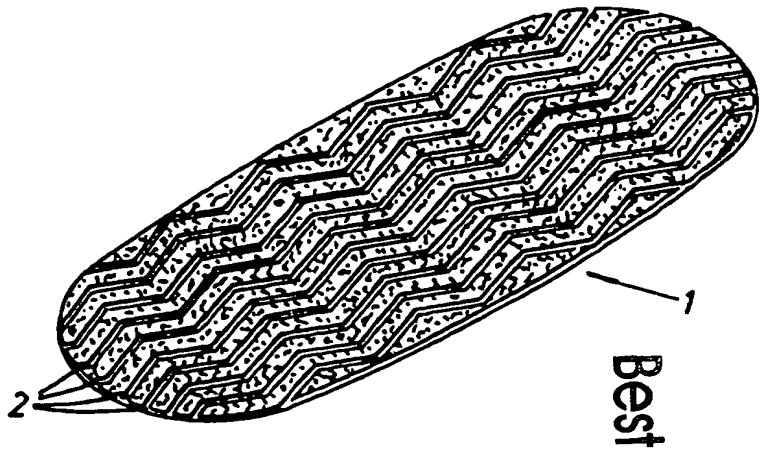
(57) Abstract

The invention relates to a fluid distribution and/or absorbent web provided with a plurality of channels (2) for directed distribution of liquid. The web (1) is made up from a wet-formed material, such as tissue, paper or non-woven, in one or more layers of cellulose fibres mixed with synthetic fibres, and the longitudinal channels (2) are formed by embossing under low pressure of the wet-formed fibre material constituting the web.



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Fluid Distribution and/or Absorbent Web

The present invention relates to a web with a material composition having properties permitting fluid distribution and/or absorption, and is intended for use in articles for personal hygiene, e.g. thin sanitary towels, underwear protectors, diapers, incontinence protectors etc., for clinical applications, e.g. mats for instruments used in surgical operations, and in general applications where the mentioned properties are desirable, e.g. absorbents for fish trays, packaged foods etc., the web also being provided with a plurality of channels for enabling directed liquid distribution.

Absorption products, used today in such as sanitary towels, are made up so that they prevent, as far as possible, the leakage of body liquids from the side edges of the article in question. In order to reduce risk of leakage from the area where the secreted body liquid first comes into contact with the towel, it may happen that the absorption bodies in the products are provided with longitudinal channels for spreading out the liquid. The materials used here up to now are usually dry-formed, absorbing fibres, which may also include synthetic fibres, and are usually embossed at high temperature and pressure to provide longitudinal channels for directed longitudinal distribution of the liquid deposited on the products.

The object of the present invention is to achieve a web of the kind mentioned in the introduction and which is made up from a wet-formed fibre material, e.g. tissue, paper or non-woven, comprising a mixture of cellulose and synthetic fibres, the web being provided with channels embossed on it under low pressure, with the intention of acquisition, absorption and fluid distri-

bution properties for dealing with liquids deposited on the web.

In contradistinction to the tissue material in accordance with the invention, a conventional tissue based on cellulose fibres alone has limitations, primarily in its dimensional stability, but also in its ability to facilitate fluid distribution. This low stability results in that the tissue material collapses when it becomes wet, becoming elongated in length and width, particularly in length. Liquid distribution in this kind of tissue is greater transversally than longitudinally, due to the creping it is given during manufacture. These limiting characteristics of conventional tissue make it unsuitable for the rapid absorption and directed fluid distribution, where these material properties have high priority, even though the tissue be provided with channels. One condition for obtaining the desired properties is dimensional stability of the paper structure in a wet state, and this can be obtained by an mixture of synthetic fibres. The negative effect of creping, which limits absorption and fluid distribution properties, can be counteracted by embossing channels into the web. With channels and a synthetic fibre mixture a ratio of 5:1 can be obtained between longitudinal and transverse fluid distribution in the tissue. Furthermore, capillary action in it can be amplified even more by adding so-called microfibres in the wet process.

The invention thus relates to a web having properties enabling fluid distribution and/or absorption, in which the above-mentioned limitations have been eliminated. The distinguishing features of the invention are disclosed in the accompanying claims.

Due to the invention, there has now been achieved a fluid distribution and/or absorbent web, which excellently fulfils its purpose, while being both cheap and easy to manufacture. The web made up from wet-formed fibre material in accordance with the invention has, as previously mentioned, very good properties with respect to directed fluid distribution along the fibre material, a ratio of 5:1 being obtainable for longitudinal contra transverse fluid distribution. In addition, good, i.e. rapid, acquisition is afforded in the web, since the inventive fibre material provides rapid fluid distribution along the channels and since channel depth is sufficient to enable rapid acceptance of liquid. With the special fibre furnish of the web it is possible, in accordance with the invention, to emboss, under heat and low pressure, the wet-formed fibre material so that longitudinal channels are formed and these keep stable in shape in a wet state also. This is a necessity for the above-mentioned fluid distribution along the channels to take place. The bottoms of the channels comprise compressed fibre material of lower porosity, while the crests between the channels comprise non-compressed fibre material of higher porosity. The density and substance of the fibre material are adjusted to suit the kind of liquid that is going to distribute and/or be absorbed by the web.

Acquisition in an absorbent product, as well as its capacity for fluid distribution, are properties that are improved in the newly developed, inventive fibre material by using the mentioned heat-embossing process. Acquisition, which is measured inwards from the surface of a body, is the absorption rate measured as the quantity per time unit the product will accept. This means that all flow directions coact to provide acquisition acording to the invention, above all in the

longitudinal (X) and inward (Z) directions in relation to the material in question.

The invention will now be described in more detail below, and with reference to the accompanying drawings, where:

Fig. 1 is a schematic, perspective view of a fluid distribution and/or absorbent web made up in accordance with the invention from tissue, paper or non-woven,

Fig. 2 is a fragmentary cross-section through a roll nip formed by embossing and rolls used for embossing channels into the web,

Fig. 3 is a schematic, perspective view of a thin, sanitary towel that includes a web in accordance with the invention,

Fig. 4 is a partial, schematic, perspective view of a fluid distribution and/or absorbent web in an alternative embodiment, where super absorbent material (SAP) is applied in strings between at least two layers of tissue material,

Fig. 5 is a partial, schematic, perspective view of a further alternative embodiment of the inventive web, where there are strings of SAP between at least two fibre material layers situated between single, longitudinal channels,

Fig. 6 illustrates the embodiment as in Fig. 5, but supplemented by so-called "progressive" fluid distribution material,

Fig. 7 schematically illustrates how four webs in accordance with an embodiment of the inventive web are

built up according to the invention to form part of a diaper,

Fig. 8 schematically illustrates another embodiment of the invention, where the web is formed with crests and channels at a relatively small pitch,

Fig. 9 illustrates an alternative embodiment of the invention similar to the one in Fig. 8, but where the crests are porous, and

Fig. 10 illustrates a further alternative embodiment of the invention similar to the one in Fig. 8, but where the web is supplemented by a progressive fluid distribution material.

As will be seen from the drawings, the present invention comprises a fluid distribution and/or absorbent web 1, for use in a great variety of applications, as recited in the introduction. The web has a plurality of longitudinal channels 2 for directed fluid distribution and absorption of liquid deposited on it. According to a preferred embodiment example of the invention, the web 1 is made up from a wet-formed tissue of cellulose fibres that are blended with a proportion of synthetic fibres. Longitudinal channels are made in the wet-formed tissue material constituting the web 1 by heat-embossing under low pressure. The inventive material is manufactured according to a wet-forming process where staple fibres based on synthetic material are mixed in a percentage of between 5 and 70% to the cellulose fibres.

An example is illustrated in Fig. 3 of a product that includes a fluid distribution and/or absorbent web in accordance with the invention. The web 1 is in this case included in a thin, sanitary towel 4, which com-

prises a bottom, an impermeable layer 5 and a permeable top covering layer 6, between which an inventive web 1 and a normally used absorption member 10 are arranged. In order to eliminate sharp transitions at the web 1 and member 10 situated between layers 5 and 6 the former have flattened outer portions 3, which also taper off outwardly. This reduces discernibility of the towel in the knickers or other underwear, in which it is usually situated when in use.

In accordance with the invention, the web 1 is made up from a wet-formed tissue of cellulose fibres, to which has been added a proportion of synthetic fibres. A plurality of longitudinal channels 2 has been heat-embossed into the web, as previously mentioned, in combination or not with strings of SAP.

In Fig. 2 there is illustrated a fragmentary cross-section through a roll nip 8, used in accordance with the invention in the production of the web 1 for heat-embossing it, which is performed with the aid of at least one roll nip 8. The latter includes at least one steel roll 7 and at least one rubber roll 9. Consecutively arranged roll nips 8 may also be arranged if required. In an exemplified embodiment of the invention, the roll or rolls 7 may have a temperature of between 110 and 200°C, and the roll or rolls 9 a temperature of between 60 and 120°C. Alternatively, the nip 8 may include at least two steel rolls, i.e. the rubber roll 9 is replaced by a steel roll. There can be an advantage in preheating the material for the web 1 before its entry into the nip 8. Particularly for high production speed it is advantageous for the web material to have a temperature of between 100 and 160°C, and its feed rate is decisive for the selection of other parameters, which together determine what desired temperature the web material has, or is given in the

nip 8. In the preferred embodiment example this temperature is between 100 and 200°C, preferably 140-170°C, depending on what types of fibre are used. In the nip or nips 8 it is advantageous to have a linear pressure of between 2 and 50 N/mm, preferably 10-20 N/mm. Another parameter is the hardness of the rubber roll or rolls 9, and in the present example this may be between 40 and 80 Shore A. In an alternative embodiment, embossing may be performed in accordance with the invention without supplying heat, i.e. so-called cold-embossing.

According to the preferred embodiment example illustrated in Figs. 1-3 of the web 1 in accordance with the invention, it has been implemented with longitudinal channels 2 in a zig-zag configuraton, which may of course vary considerably, e.g. a sinusoid form or rectilinear form. The web 1 may also be used to advantage as a fluid distribution layer for absorption bodies known per se.

The inventive web may be provided with strings 11 of SAP for enhancing its ability to cater for distribution and absorption of the liquid in question. The strings 11 are then suitably arranged at given spacing, and in the longitudinal direction of the channels 2. The strings 11 may have a width of 2-8 mm, preferably 5 mm, and a mutual spacing of 10 mm, for example, with a tolerance of ± 5 mm, and are disposed longitudinally between at least two layers 12 and 13 included in the web 1. With the strings 11 in place, the channels are then embossed into the web at low pressure, this operation resulting in that the SAP material is pressed into the interstices of the tissue material fibres. The directed distribution in the web is thus amplified, while the super absorbent is better utilized. Depending on the field of use and desired effect of the inventive

web 1, it is possible to vary the parameters relating to type and amount of SAP in the strings 11, their pitch, and the tissue material quality and properties so that the web 1 will be adjusted to the liquid in question. To increase its acquisition the web may, of course, be perforated.

According to the embodiments illustrated in Figs. 4 and 5, the web 1 includes two layers of tissue material 12, 13, which are embossed with channels 2 after strings of SAP have been put in place. It will be seen from Fig. 4 that the web 1 is provided with SAP material 11 disposed beneath a crest formed in the tissue material and the crest may be either porous or impermeable. The crests 2' have channels 2 on either side, each channel 2 being juxtaposed to the position occupied by SAP material, alternate crests 2' being formed without SAP material. The distance A between the SAP strings 11 is about 10 mm and their width B is between 2 and 8 mm, preferably 5 mm. In the embodiment of Fig. 5, the web 1 has the longitudinal string 11 disposed between layers 12 and 13 of tissue material, with a channel 2 on either side, but with no intermediate crest 2' as in Fig. 4.

According to the embodiment examples described above, the strings of SAP may also be implemented as cut strips of SAP film and as narrow bands or filaments they may be utilized in the web in bundles forming the strings.

As has been mentioned above, it is advantageous to emboss the two layers 12 and 13 of the web enveloping the SAP strings after the latter have been appropriately positioned.

In Fig. 6 there is illustrated an alternative embodiment of the inventive web 1, where it may have a thickness outside the SAP strings of about 0,5 mm, and where it is supplemented by a so-called progressive distribution material, which is made up from fibres that are coarser uppermost and finer bottommost for amplifying fluid distribution, absorbency and softness. In other words, a material is intended here that may have a total thickness of about 1-2 mm, with its surface layer including fibres that are more open, due to their coarseness and interrelationship, than fibres that are finer and situated lower down in the material, as well as having closer interrelationship.

In Fig. 7 there is illustrated an application of the inventive web when used for the core of a diaper. The web is of the type illustrated in Fig. 5 and four complete layers of it are used. The layers 12 and 13 of each individual web in accordance with the invention envelop between them the SAP strings 11 extending longitudinally in the web 1 with channels 2 on either side.

The embodiment of the inventive web 1 illustrated in Fig. 8 has relatively closely arranged channels 2 and crests 2'. In this example the widths C and D of channel and crest, respectively, are equally as great and preferably about 5 mm.

The embodiment of the inventive web 1 illustrated in Fig. 9 has the same appearance as the one in Fig. 8. The difference here is, however, that the channels 2 are impermeable while the crests 2' are porous. In this way there is achieved, as required for certain applications, better acquisition through several layers and the channelling effect of the channels 2 for acquisition through the web 1 by the liquid desposited on it.

In fig. 10 there is illustrated an embodiment of the inventive web 1, where it is supplemented by the progressive fluid distribution material 14. The channels 2 are placed at relatively small mutual spacing in this case, to encourage distribution of the liquid deposited on the web 1 in the longitudinal direction of it and the channels. The progressive material is provided to increase acquisition and distribution ability with the aid of the increased capillary effect.

Claims

1. Fluid distribution and/or absorbent web having a plurality of longitudinal channels (2) for directed fluid distribution and/or absorption of liquid, characterized in that said web (1) is made up from a wet-formed fibre material, such as tissue, paper or non-woven, in one or more layers of cellulose fibres with a mixture of synthetic fibres, and in that the longitudinal channels (2) are formed by embossing under low pressure of the wet-formed fibre material constituting said web.

2. Web as claimed in claim 1, characterized in that the proportion of synthetic fibres in the fibre mixture is between 5 and 70%, preferably 15-40%, and in that the longitudinal channels (2) are formed by heat-embossing.

3. Web as claimed in claim 1, characterized in that said web (1) has rolled-out outer portions (3) tapering off outwardly.

4. Web as claimed in claim 1, characterized in that said channels (2) are longitudinally configurated in a zig-zag form, S-form or are rectilinear and extend close to each other over the width of the web, and in that the bottoms of said channels (2) comprise compressed fibre material, while crests (2') therebetween preferably comprise fibre material, which has not been compressed.

5. Web as claimed in claim 1, characterized in that said web (1) has a super absorbent material (SAP) applied preferably in string-like form between at least two layers.

6. Method of producing a fluid distribution and/or absorbent web, **characterized** in that said web (1) is made up from at least one layer of a wet-formed cellulose fibre material, into which is mixed a proportion of synthetic fibres, said web being provided with a plurality of longitudinal channels (2) by embossing at low pressure, for directed fluid distribution and absorption of liquid.

7. Method as claimed in claim 6, **characterized** in that embossing is performed with the aid of heat in at least one roll nip (8) between at least one steel roll (7) and at least one rubber roll (9), or between consecutive roll nips (8) with associated steel and rubber rolls (7 and 9), said steel roll or rolls (7) together with said rubber roll or rolls (9) and said fibre material are given a temperature attaining 100-200°C on entering said nip (8), this temperature depending on fibre type and web feed rate.

8. Method as claimed in claim 7, **characterized** in that said roll nip (8) has a linear pressure of between 2 and 50 N/mm, and preferably 10-20 N/mm.

9. Method as claimed in claim 6, **characterized** in that said web (1) is perforated to increase its acquisition.

10. Method as claimed in claim 6, **characterized** in that said web (1) is laminated with a calendered and/or micro-embossed surface material or is provided with a surface layer of some other fibre, which forms a progressively fluid distribution material (14), there thus being formed a composition with the underlying web (1) for amplifying fluid distribution, absorption and softness.

11. Method as claimed in claim 6, characterized in that a super absorbent material (SAP) is put in or on the web (1) and/or in its channels (2), preferably in the form of a powder or fibres.

12. Method as claimed in claim 6, characterized in that a super absorbent material (SAP) is applied in strings (11), such as to come between at least two fibre material layers (12, 13), subsequent to which the channels (2) are embossed in the same direction as the strings of SAP.

Fig. 1

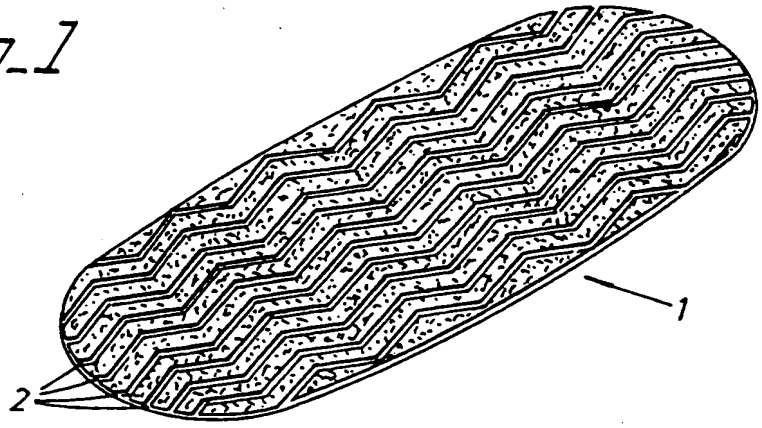


Fig. 2

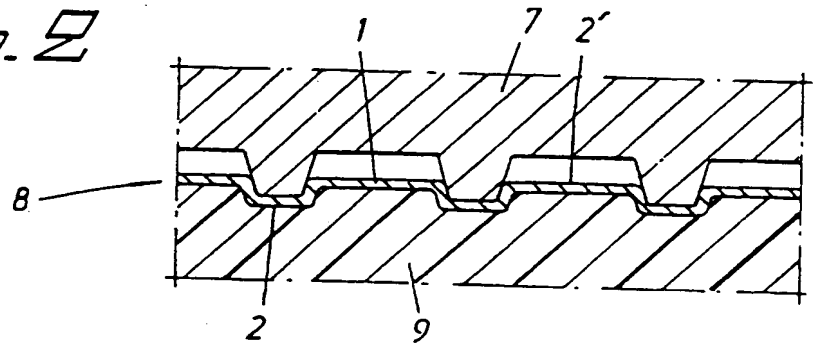


Fig. 3

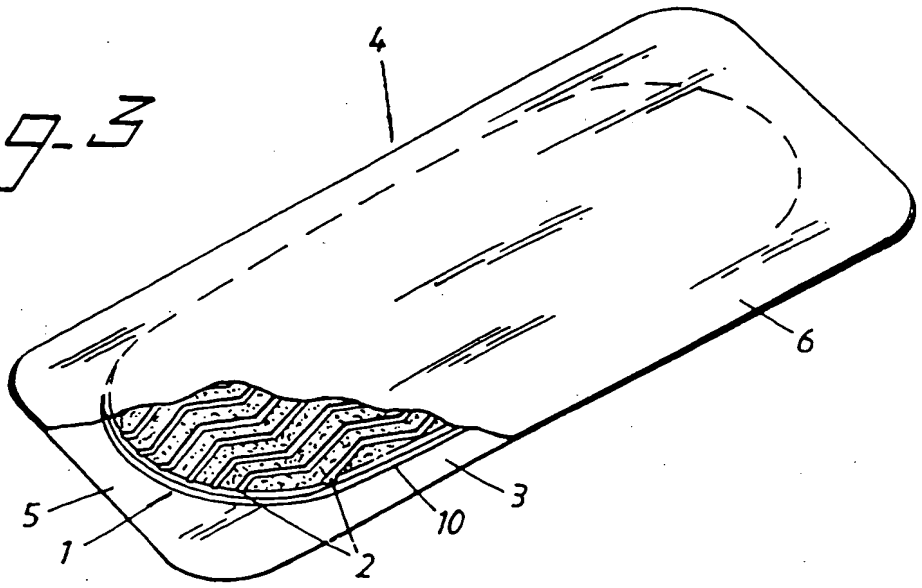


Fig. 4

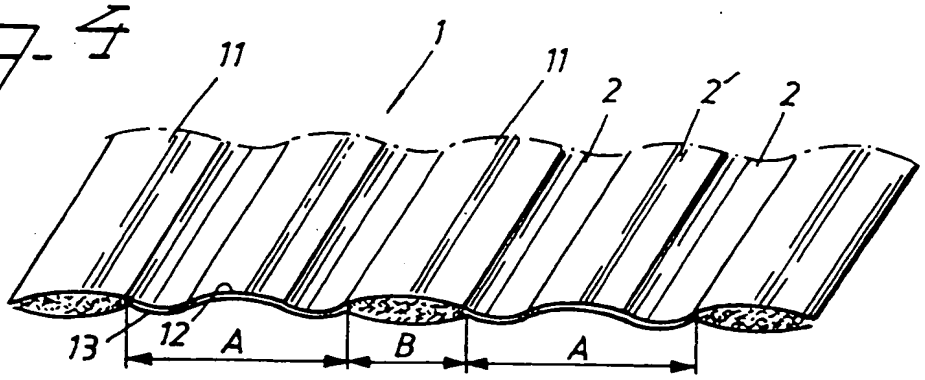


Fig. 5

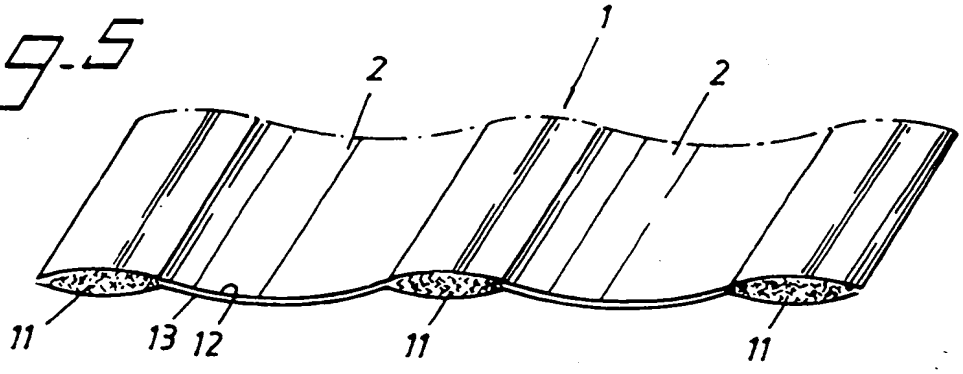


Fig. 6

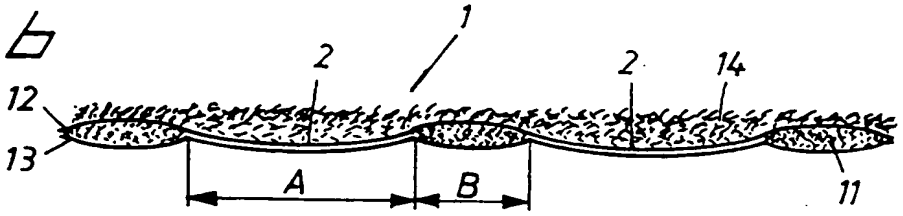


Fig. 7

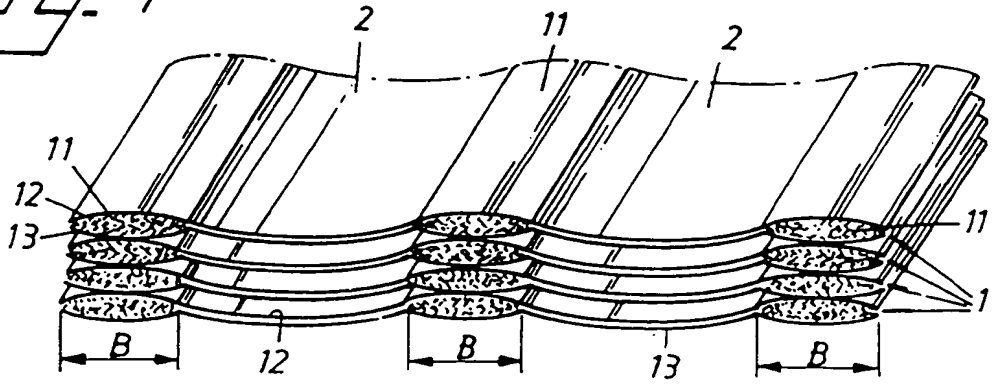


Fig. 8

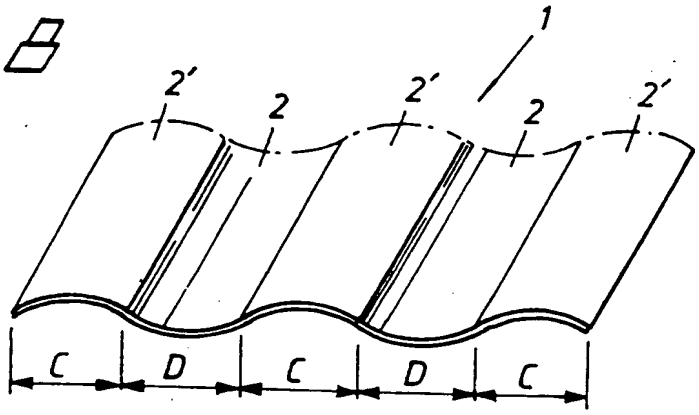


Fig. 9

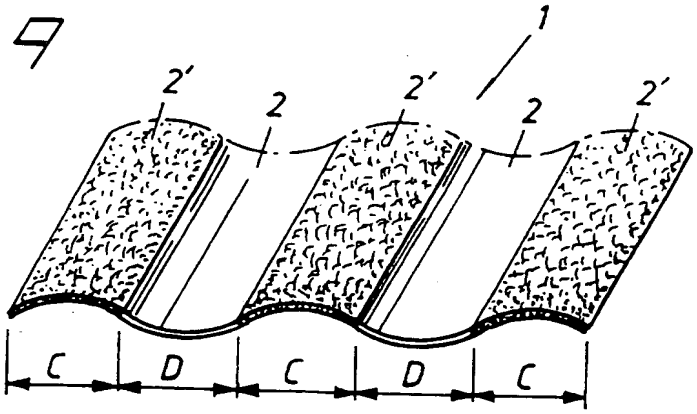
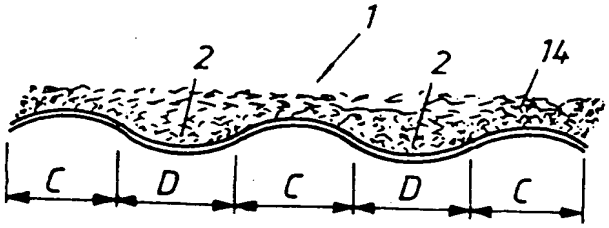


Fig. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 96/01523

A. CLASSIFICATION OF SUBJECT MATTER

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 March 1997	02 -04- 1997
Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

04/03/97

International application No.
PCT/SE 96/01523

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